AN INVESTIGATION OF THE SCULPTURAL POSSIBILITIES OF WARP DISTORTION AND MANIPULATION THROUGH WARP WEIGHTING

PROBLEM IN LIEU OF THESIS

Presented to the Graduate Council of the
North Texas State University in Partial
Fulfillment of the Requirements

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MASTER OF FINE ARTS

By

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CHAPTER I

INTRODUCTION

My work with fibers began with off-loom methods of constructing three dimensional forms. When I began weaving, I still wanted to pursue a more sculptural effect. To achieve this, I have been working with tubular forms combined with various surface distortions. It was my interest in surface distortion for a sculptural form that gave me the desire to investigate the effects of warp weighting.

Traditionally, warp weighting was used by many groups of primitive weavers who sought to weight their warps evenly and produce a flat woven fabric. Their looms consisted of an upper beam to which the warps were attached by means of wrapping or pegs. The warps were held taut with rocks or ceramic discs tied to the other end (6:346). The fabric was woven from top to bottom and as such, the weft was beaten upward.

It is common to find illustrations of this type of loom on Greek vases dating from sixth and fifth centuries B.C.: although, the oldest evidence of a weighted loom was found by Carl W. Blegen in an archeological dig on the site of Troy. The discovery consisted of several loom weights which have been dated 3000-2700 B.C. (3:18).

Statement of the Problem

The purpose of this project is to investigate the sculptural possibilities of warp distortion and manipulation through the utilization of the weighted-warp process.

Some surface variations can be achieved by weighting the warps irregularly. This type of weighting results in a distortion of the warp because in a warp area which is tightly tensioned, the wefts tend to pack close together. However, when a warp area is loosely tensioned, the wefts tend to pack further apart. The conflict between these different degrees of tension on a single woven surface produces a surface variation or warp distortion similar to that created when pulling a fabric cross-grain.

A secondary purpose is to explore the technique of warp weighting beyond a single fabric layer. It is projected that a weighted layer can be combined with one which is tensioned evenly and tied onto the floor loom (loom tensioned). In this manner, the loom-tensioned layer remains stable. The weighted layer is free to move through the heddles while maintaining tension on the warps.

An example of a similar process can be found in pleat weaving where the top layer of fabric is woven up twice as far as the ground layer. The pleat is held in place when the two layers are woven together (5:124). With this process the fabric is distorted through manipulation rather than through the weight variations described previously.

The specific questions of my investigation are as follow:

1. What type of sculptural effects can be achieved through weight variations on the warp of a single layer of woven fabric?

2. What type of sculptural effects can be achieved in a two layer fabric construction when loom-controlled tension on one layer is combined with weighted tension on the other?

3. What type of sculptural effects can be obtained in a four layer fabric construction when two layers have loom controlled tension and the other two have weights supplying tension?

To investigate these questions, three pieces of single layer fabric were woven as well as six pieces of two layer fabric and three pieces of four layer fabric.

The weaving took place on a standard eight harness floor loom. All of the layers which were not loom tensioned were held taut by means of plastic containers tied onto the warps and filled with varying amounts of water.

The weaving process was documented with a written journal and in-process photographs. The completed pieces were also documented photographically. A content analysis of both the written and visual material was made in order to respond to the questions posed.

VOCABULARY

1. E.P.I.--warp ends per inch as measured across the reed.
2. Loom-controlled tension or loom tensioned--in weaving, tautness of the warps when stretched between the warp

beam and the cloth beam.

3. Reed--a comb-like device set into the beater on a loom. The reed helps to maintain the horizontal position and spacing of the warp yarns and also beats each new weft yarn into position.
4. Selvedge--the lengthwise or warpwise edge of a woven fabric; the point at which the weft yarns bind the warp to form a finished edge.
5. Sett--the density of a fabric; the number of warp yarns per inch, especially as sleyed, or spaced, at the reed.
6. Warp--a set of yarns that are parallel to one another and to the selvedge or longer dimension of a woven fabric; the lengthwise element in a woven construction.
7. Weft--a set of yarns or other material perpendicular to the selvedge or longer dimension of a woven fabric; the crosswise element in a woven construction.
8. Weight-controlled tension or weighted tension--in weaving, tautness of the warps when stretched from the cloth beam and over the back beam by means of weights tied onto the warps.

CHAPTER II

THE WOVEN PIECES

The first part of the project was concerned with achieving sculptural effects through weight variations on the warp of a single layer of woven fabric. Three tubes were woven to examine these possibilities.

Tube A (Fig. 1-A and 1-B)

On this piece I weighted the warps in groups of two inches, as measured in the reed (Fig. 1-C). Each of the eight groups was held taut by 10.6 grams of weight.

As can be seen in the draft (Fig. 1-A), the tube was woven in plain weave. However, the anticipated weave variations failed to be significant. To adjust this, I removed half of the water weight in order to increase the weight difference between loom tensioned and weighted warps. The surface variations remained minimal.

It appeared that the problem must be that the number of warp ends per inch was causing the fabric to be rather firm and thus not allowing significant surface variations (Fig. 1-D and 1-E).

Tube B (Fig. 1-A)

Tube B was also woven plain weave from the same diagram as Tube A (see Fig. 1-B); however, the number of warp ends per inch was decreased. Due to the change in the number of warp ends per inch, significant surface variations appeared in the fabric (see Fig. 1-F and 1-G).

Tube C (Fig. 1-A and 1-H)

Once again, the number of ends per inch was decreased and the weighted areas were narrowed. Significant variations in the form of tight uniform folds occurred. I wanted to see whether the width of the weighted area would change the fold configuration at this sett. The width was changed to five inches, and the resulting folds became less uniform and tended to drape (Fig. 1-I and 1-J).

As a result of the three single layer experiments, it was determined the warp distortion and manipulation through warp weighting is a technique which yields a variety of surface variations. These can be utilized by the fiber sculpture oriented weaver to re-define surface and space.

Weight variations on a single layer fabric construction will distort the warps and yield sculptural effects in the form of folds. These folds can be varied to achieve different effects as in:

1. Narrow weighted areas, two to three inches, produce a more uniform variation in the form of rows of folds.

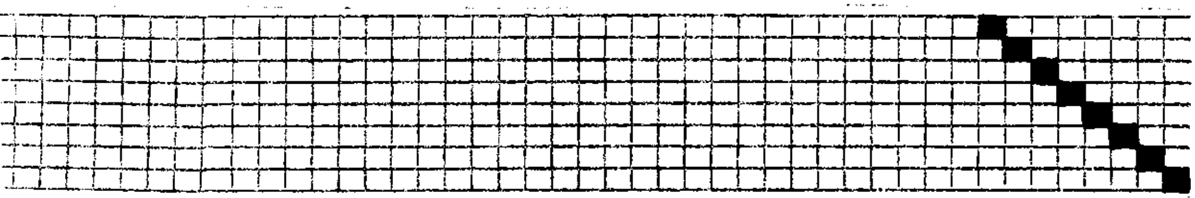
2. Wider weighted areas tend to drape rather than fold.

3. The number of warp ends per inch has a pronounced effect on the folding action, with fewer warp ends per inch allowing significant folds and more warp e.p.i. allowing less obvious folds.

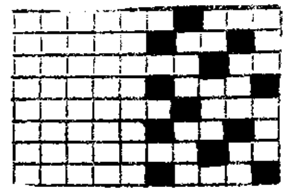
4. The difference in tautness between areas of loom controlled tension and weighted tension also has a pronounced effect on the warp distortion--the greater the difference, the more distortion.

PROJECT One Layer - Tube A

Threading Draft

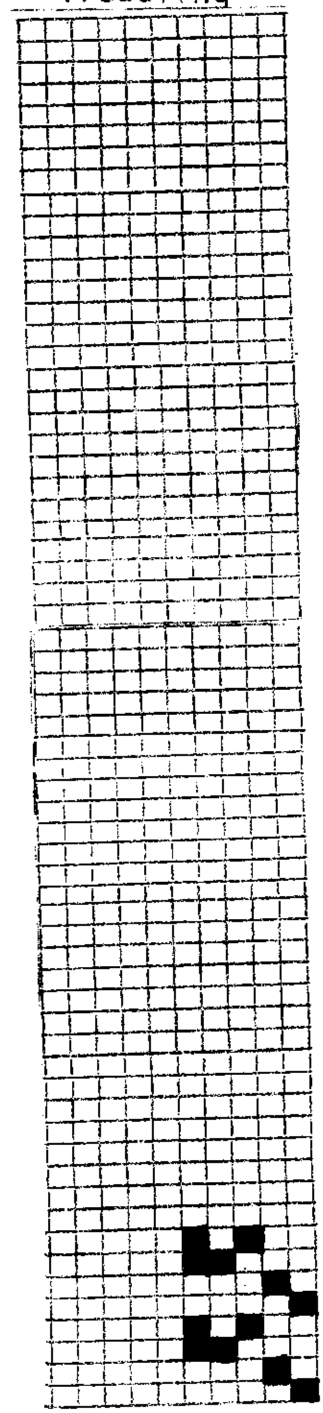


Tie-up



REED & SETT 12 dent reed 24 e.p.i.

Treadling



SIZE: Width 24"

Length 4 yds. warp 9' finished length

WARP: Linen/rayon produced by Scott's Woolen Mill under the name "Linnay." Warp is pewter colored.

FILLER: "Linnay" - natural and pewter

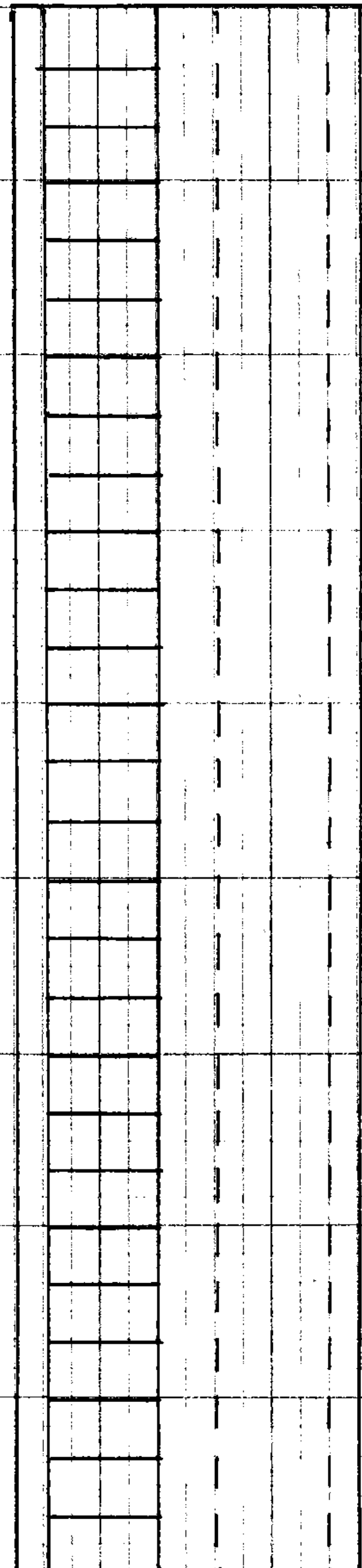
MISCELLANEOUS INFORMATION:

Treadling and threading is the same for all three pieces in this problem. Only the sett and the amount of weight used to tension will vary.

Tube B: 16 e.p.i. - 8 dent reed

Tube C: 8 e.p.i. - 8 dent reed

Fig. 1-A. Threading Draft, one layer



Scale: 1 block = 3"

Fig. 1-B. Diagram of Tubes A and B as weighted

Fig. 1-C. In process work, loom weights

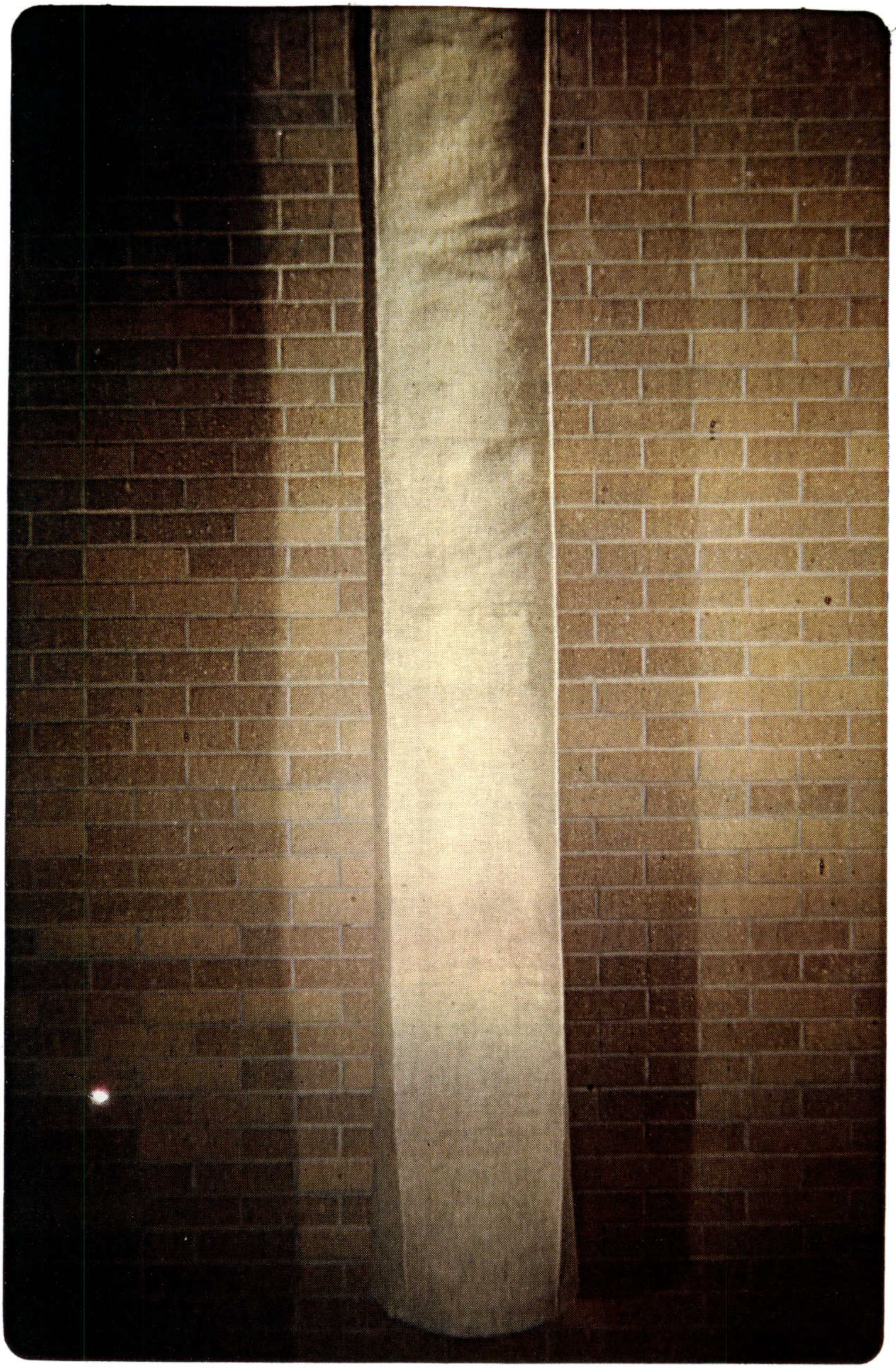
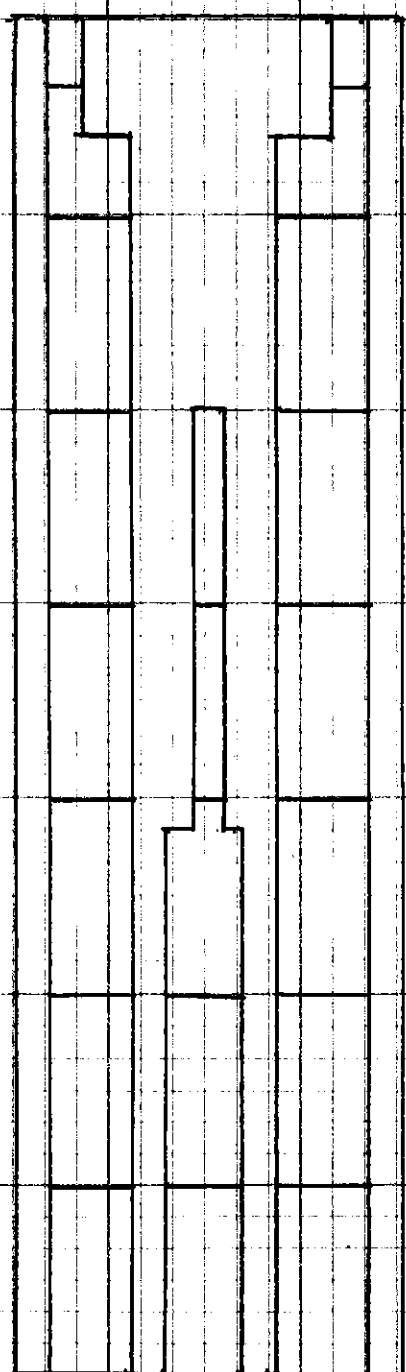


Fig. 1-D. Tube A

Fig. 1-E. Detail of Tube A

Fig. 1-F. Tube B

Fig. 1-G. Detail of Tube B



Scale: 1 block = 3"

Fig. 1-H. Diagram of Tube C

Fig. 1-I. Tube C

Fig. 1-J. Detail of Tube C

The second part of this project was concerned with achieving sculptural effects through combining a loom-tensioned layer of fabric with one which was tensioned by means of weights. Six pieces of two layer fabric were woven to examine these possibilities (Fig. 2-C).

The first piece was a sample strip which was approximately three inches wide and thirty-two inches long. A modified form of the pleat weaving technique mentioned in the introduction was utilized in the sample. Each "pleat" or manipulation varied in length from two to five inches, but in all cases the top layer was woven one and a half inches further than the ground layer before it was pulled back evenly and held in place by weaving the two layers together.

There were a few problems with the sample strip in that weaving the two layers together for a few shots was not sufficient to withstand the tension of the weights. Thus, the folds tended to flatten out. In order to compensate for this, I used a needle and thread to temporarily baste the folds in place. The basting was removed after the piece came off the loom. The folds were effective.

I experimented with the sample strip, hanging it in various positions in order to see how the folds worked from different vantage points. I concluded that they were best suited to be suspended with the loom-tensioned layer facing the ceiling. From this position, the strip took on a wing-like or flying appearance. This supplied the inspiration for the major piece of this problem (Fig. 2-A and 2-B).

I continued to weave strips because they lent themselves to the type of surface I wanted to create. As the strips were completed, they were sewn together and suspended so I might get a more accurate view of the feeling I was trying to convey.

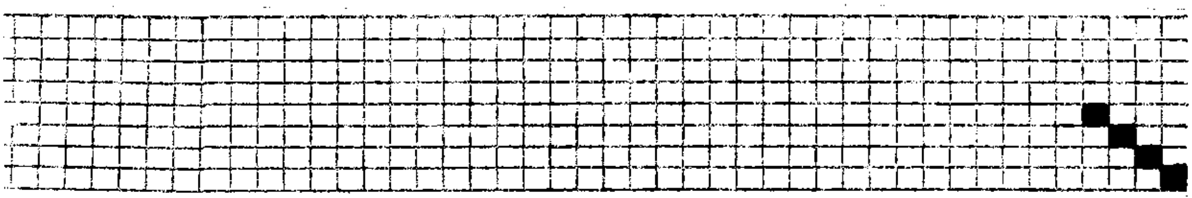
The strips varied in overall length and width as well as the length of each surface manipulation (Fig. 2-B).

This project was designed as a model which could be enlarged five times its present size.

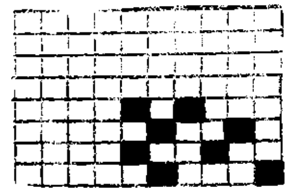
As a result of the six two-layer experiments, it was discovered that significant sculptural effects can also be gained in a two fabric layer construction with loom-controlled tension on one layer of warps and weight-controlled tension on the other. The effects were the result of the weaver's manipulation of the weighted warp. Manipulations were seen in the form of open-ended folds whose arrangement, size, and interaction would yield a variety of effects; however, the basic warp manipulation or module would remain the same.

PROJECT Two Layers

Threading Draft



Tie-up



REED & SETT 12 dent reed, 12 e.p.i.

SIZE: Width see diagram

Length see diagram

WARP: Perle 3 natural cotton produced by Lily Mills

FILLER: Cotton surgical gauze.

MISCELLANEOUS INFORMATION:

1. warps on harness 1 and 3 are weighted.
2. warps on harnesses 2 and 4 are loom tensioned.
3. Treadling is modified to 1,3,1,3 in the extended areas that are to form folds.
4. Weighted layer has 1-3/4 pounds of weight per two inches of warp (as measured in the reed).

Treadling

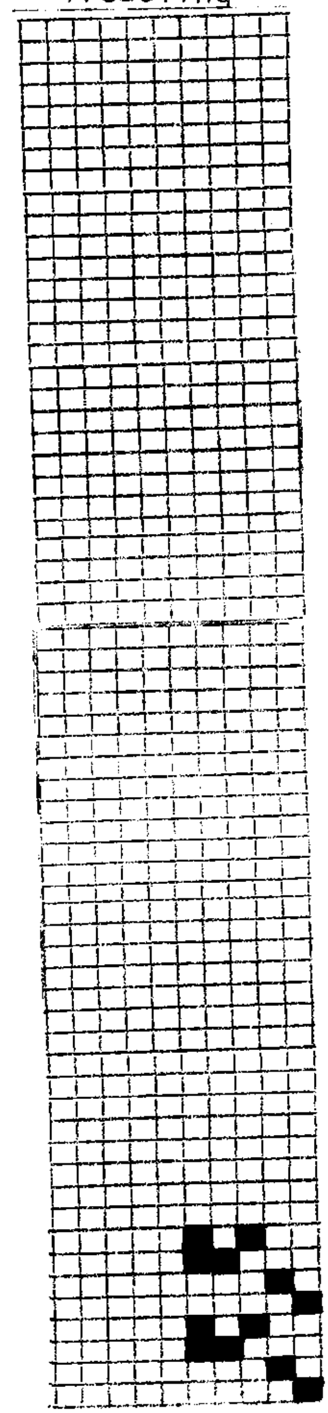
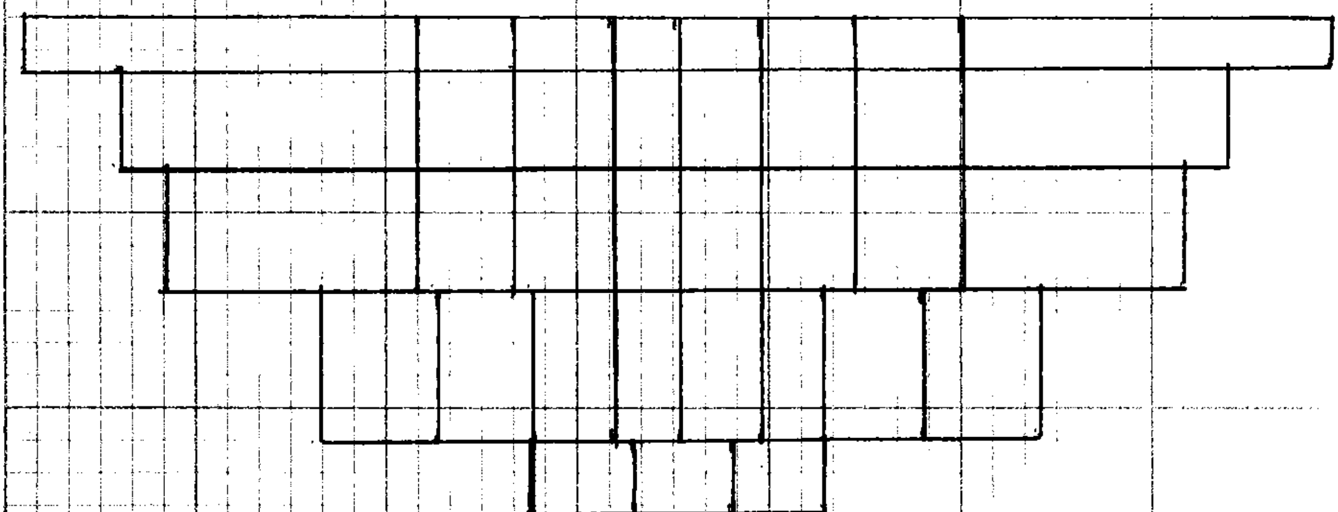


Fig. 2-A. Threading draft, two layers



First and last manipulations on each strip were woven two inches beyond the ground layer.

All other manipulations were woven one inch beyond the ground layer.

Scale: 1 block = 1"

Fig. 2-B. Diagram of two-layer piece

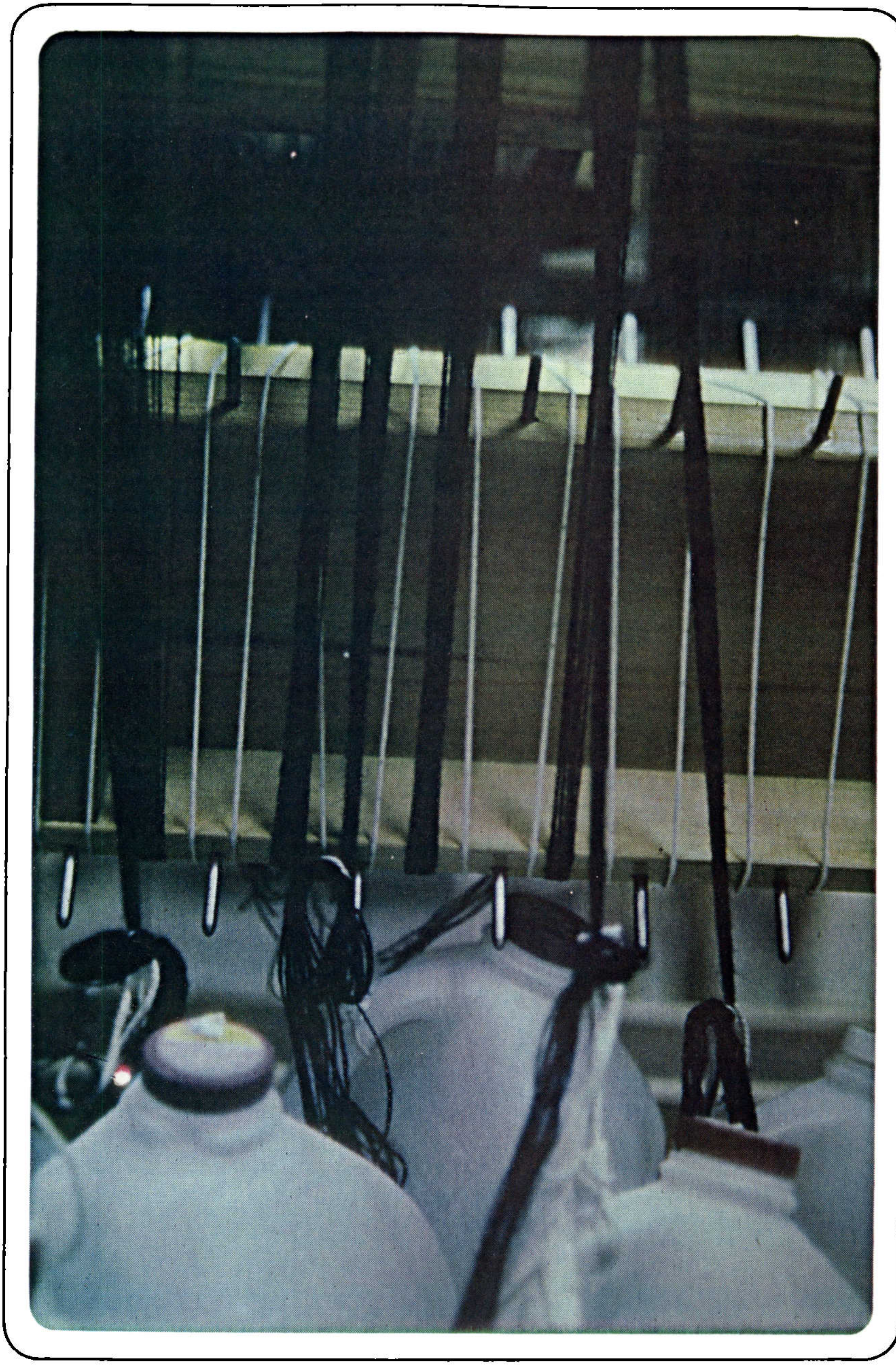


Fig. 2-C. In process work, loom weights

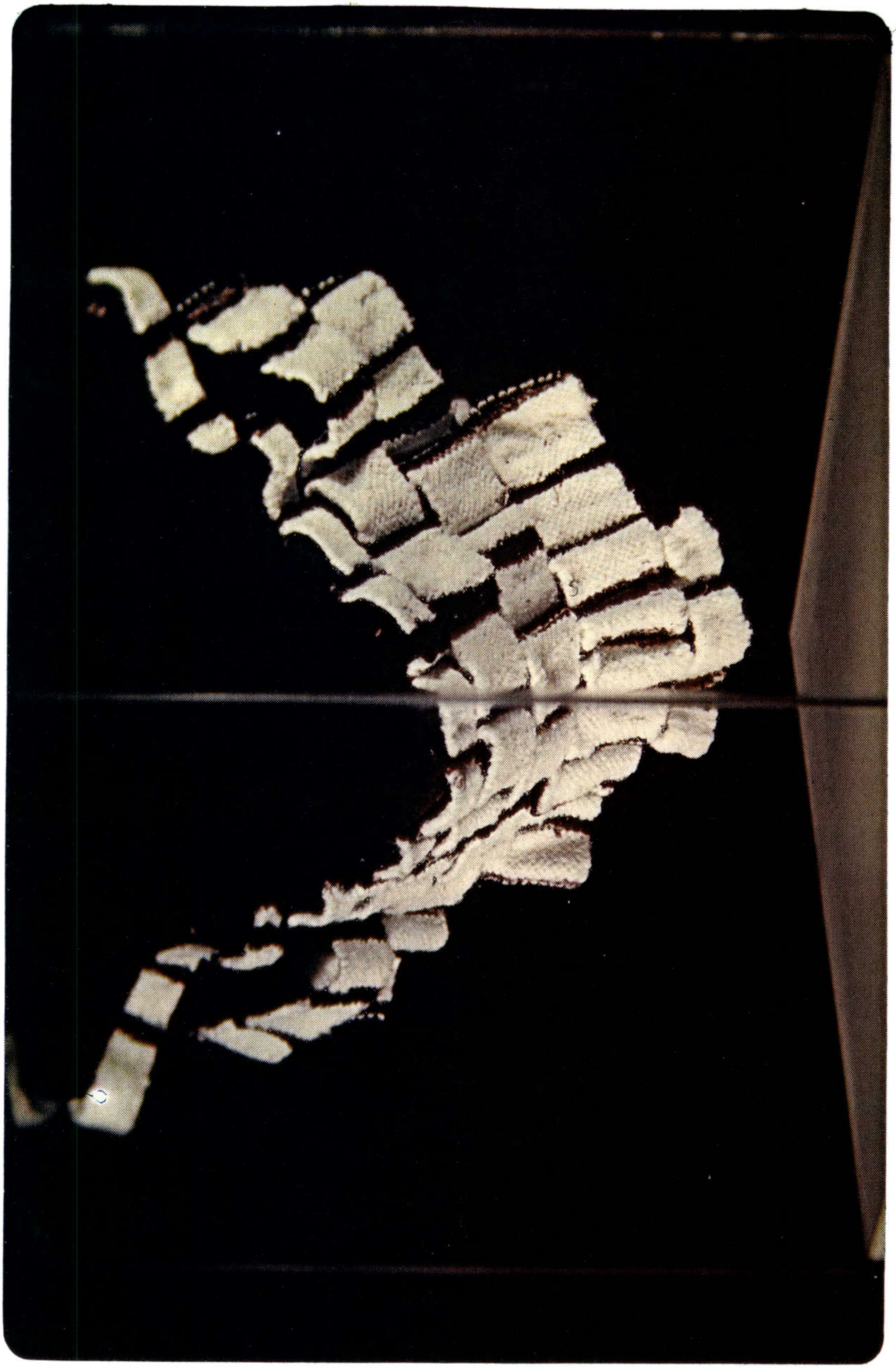


Fig. 2-D. Two-layer piece, front view

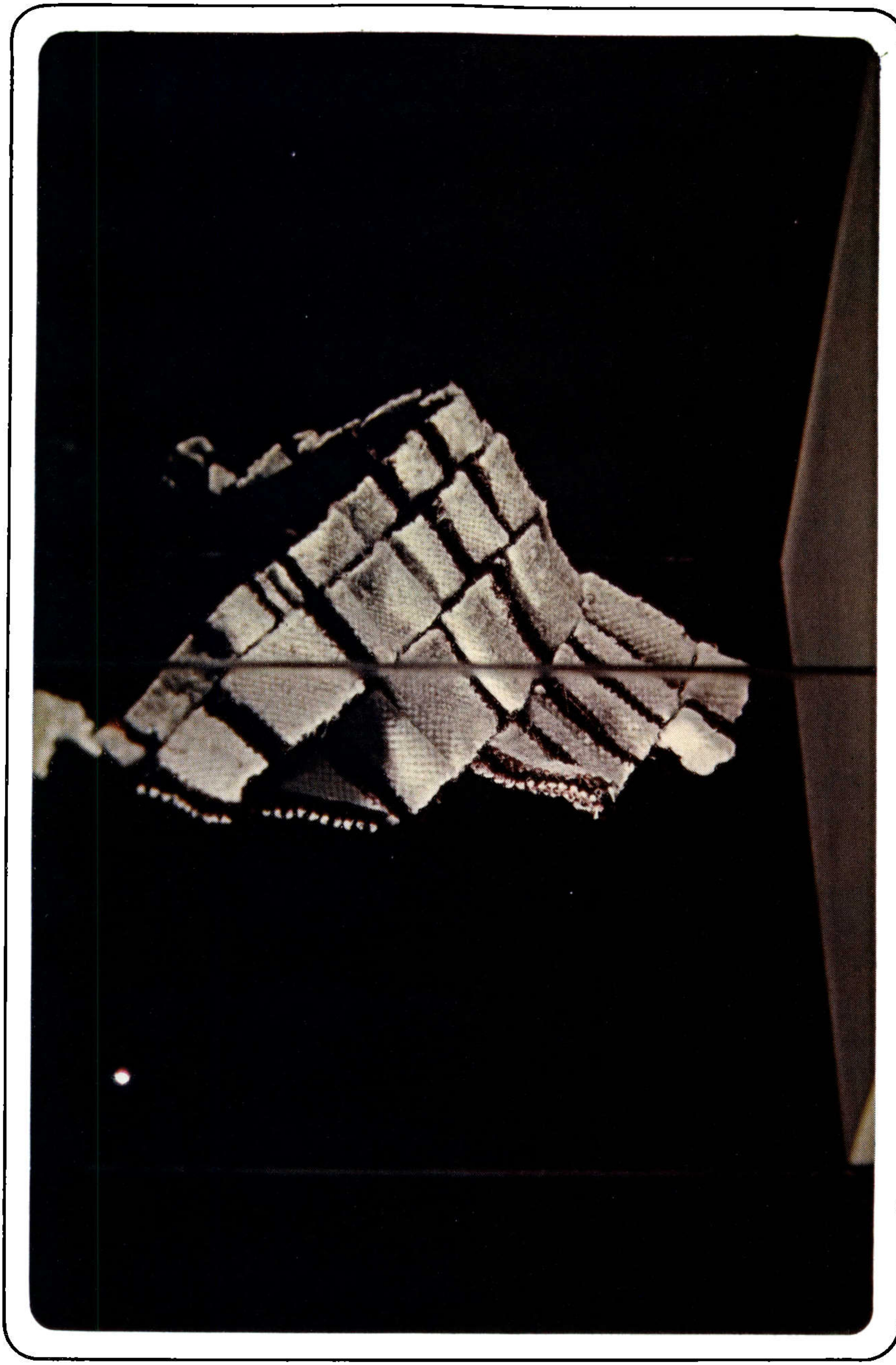


Fig. 2-D. Two-layer piece, side view

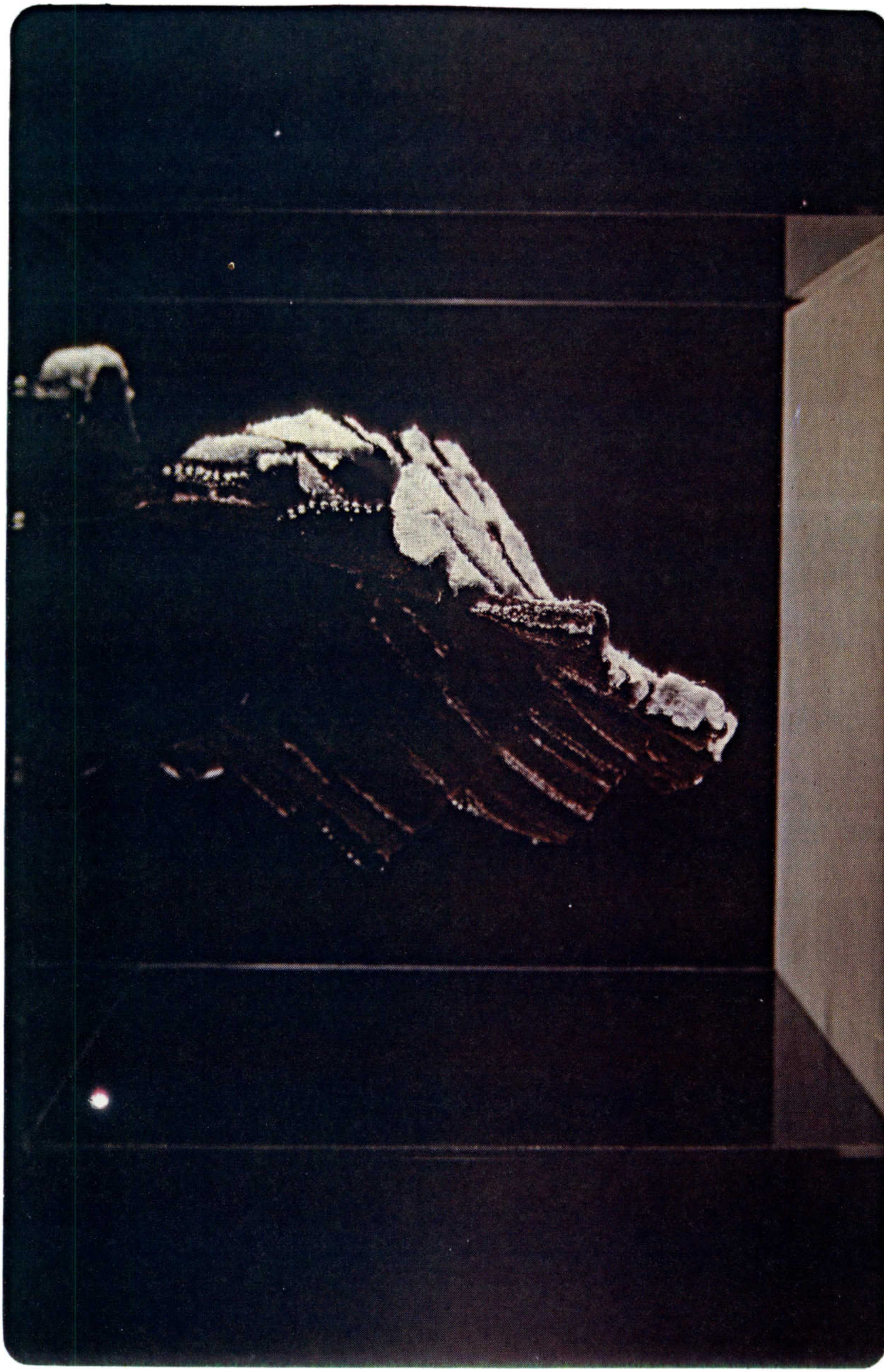


Fig. 2-F. Two-layer piece, back view

The third question of this project was concerned with achieving sculptural effects through combining two layers of loom-tensioned fabric with two which were tensioned by means of weights. Three pieces of fabric were woven to examine these possibilities.

Tube A (Fig. 3-B)

I decided to continue my tubular format for this last problem; but, because it required four layers, my weaving would have to be a tube-within-a-tube construction (Fig. 3-A).

As I began weaving, it seemed that since the inside tube would not be seen, I could allow these warps to float on the inside until I needed them to bind folds into place. In so doing, I would save both time and weft yarns.

I finished the first fold and tried to bind it in place by weaving the two tubes together only to discover that there were too many ends per inch to allow for adequate coverage of the warps. Therefore, I chose to weave the inside layer as if it were the outside layer. That is, the loom-tensioned layer was raised and woven upon instead of the weighted layer. Essentially, this crossed the layers of warps and bound the fold in place. After a short distance, the loom-tensioned layer was returned to its previous position inside the main tube (Fig. 3-G).

No further problems were encountered until the piece was removed from the loom. At this time, it was discovered that the folds could shift and slide on the unwoven, inside warps which were to have bound the folds in place. The overall length of the piece remained constant because the warps had been securely finished off, but within the body of the weaving there was much slippage and shifting.

This indicates that when utilizing a multiple layer weave with this technique, it is necessary to weave all of the fabric layers in order to avoid shifting and slippage. The problem was solved when the piece was hung, as the overall weight of the weft curtailed any shift in folds (Fig. 3-C).

Tube B (Fig. 3-E)

I wanted to try some variations of the multiple layer problem. It seemed that, if it were necessary to weave all layers in order to achieve stability, the inside layers should be utilized as part of the overall design. With this in mind, I wove tabs on some portions of the top layer as well as slits on the sides of some of the folds. This allowed the inside layers to show through (Fig. 3-E and 3-F).

The tabs varied in length and width and were woven on the weighted layer so they could be made to fold out when pulled back even with the inside tube (Fig. 3-H through 3-L). Folds were bound in place as in Tube A.

I encountered no significant problems with the weaving process. I was frustrated by the fact that the top layer was the only surface which could be woven in tabs because it was not possible to see the bottom layers as they were being woven.

When the tube was taken off the loom, I discovered that the folds were going to lay flat on the surface rather than protrude as I had envisioned. The reason for this was that the fabric lacked sufficient body in the weighted areas. As was stated earlier, when warps are less taut, the wefts will not pack as closely. In this case, it was not possible to add more weight for tension and still maintain the folds. It should also be noted that the weft was an unusually stiff fiber which did not lend itself to a close weave.

The tabs did not enliven the surface since they simply hung flat and hid the interior tube. In order to open up that space and create some sort of involvement on the surface, I manipulated the tabs by pinning them together and pulling them aside. When a suitable arrangement was found, the tabs were stitched in place (Fig. 3-M through 3-N).

It was found that the fold technique was as successful here as it was in the previous piece. Selvedge slits were also successful in that they allowed the interior tube to become visible.

Tube C (Fig. 3-E)

At this point I had learned a lot about weaving multiple layers. One thing that still concerned me was that in all of the tubes, the overall effect was much the same. Basically, they were all single, straight tubes with folds.

In an attempt to get more variety within the individual weaving, I decided to weave the same multiple layers and folds; but, rather than the simple tube-within-a-tube construction, I would also split the main shaft into multiple tubes. Each of these tubes would have its own interior tube (see Fig. 3-O).

I did not encounter any weaving problem; although, once again, I did feel hampered by not being able to see how the bottom layer was weaving.

I began to have some problems after the piece was taken off the loom. When a tube is woven on a loom, it must by the nature of the process be flattened out. When it came off the loom, I had to "round it up" by ironing against the selvedges. This piece did not want to "round up." The reason for this problem was partially the varied size and placement of the tubes within the body of the main piece; however, the nature of the process was also accountable.

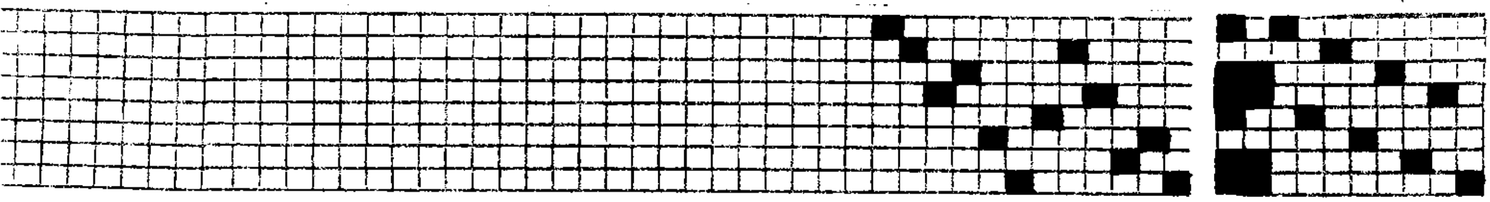
Diligent ironing against the selvedges helped somewhat, but it seemed that the longer the piece hung, the rounder it became. I attributed this to some warp shifting and weft settling.

The side slits on the folds proved to be another problem. They were too soft and tended to flop together and hid the inside tube. To compensate for this, I turned in the edges of the slits. This served to thicken the edge and gave enough added body to maintain an open position (Fig. 3-P and 3-Q).

A multiple tube approach was an interesting variation of the multiple layer, weighted problem. The effects were significant and successful, but there were some distinct disadvantages to weaving complex systems of warp-weighted tubes on a floor loom. One disadvantage is that you cannot see the bottom layer without getting under the loom; therefore, all surface variations must be uniform folds for top and bottom or simply take place on the top layer. Also, since tubes are woven flat, there is sometimes difficulty in forcing them round. Somehow, this seems to be fighting the process, and perhaps a solution could be found in weaving on an upright frame loom. The lack of a shedding device would possibly be overshadowed by being able to view the piece as a whole and from all sides while it is being woven.

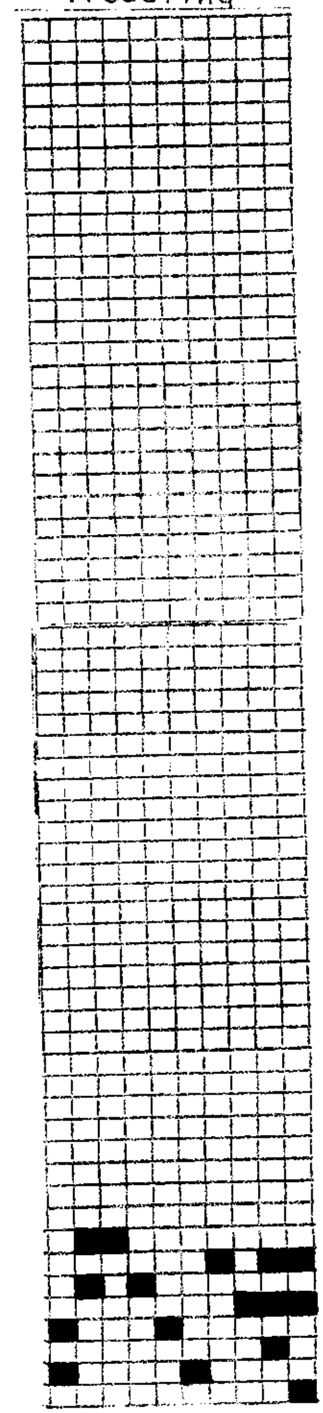
PROJECT Four Layers - Tube A

Threading Draft Tie-up



REED & SETT 8 dent reed, 8 e.p.i.

Treadling



SIZE: Width 20"

Length Warp: 3 yards loom controlled
5 yards weight controlled

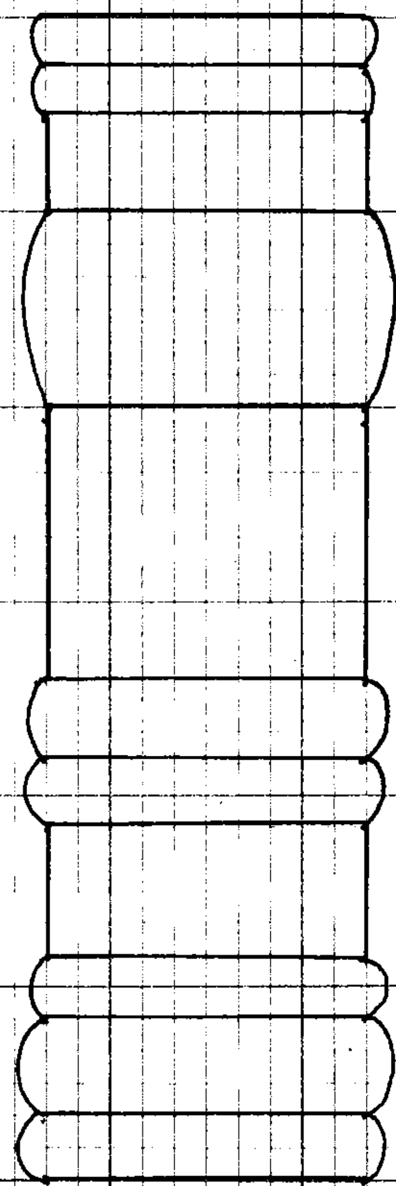
WARP: "Linnay" natural

FILLER: Greek Handspun (grey), imported by
Tanki Imports Ltd.

MISCELLANEOUS INFORMATION:

1. Warps on harnesses 1,3,5, and 7 were weighted.
2. Warps on harnesses 2,4,6, and 8 were loom controlled.
3. There were twice as many warps on the outside tube as the inside tube.

Fig. 3-A. Threading draft, four layers, Tube A.



Curved selvedges indicate a fold in the weighted warp.

Scale: 1 block = 3"

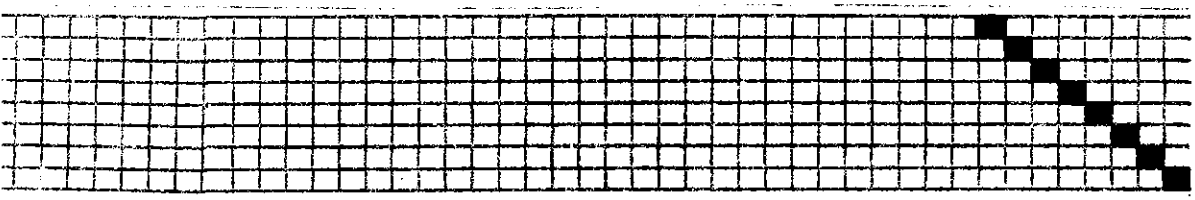
Fig. 3-B. Diagram of Tube A

Fig. 3-C. Tube A

Fig. 3-D. Detail of Tube A

PROJECT Four Layers - Tubes B and C

Threading Draft



Tie-up

REED & SETT 8 dent reed, 8 e.p.i.

Treadling

SIZE: Width 15"

Length 3 yards for loom-tensioned tube
4 yards for weighted tube

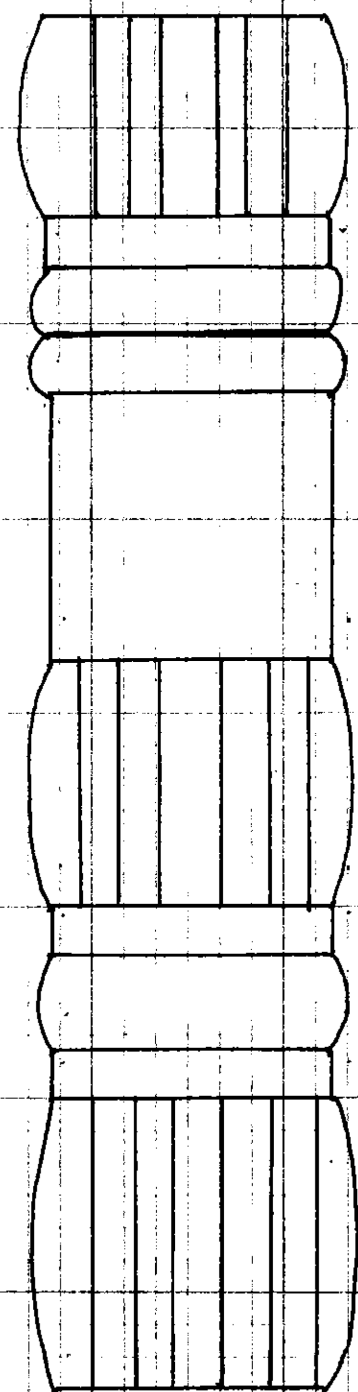
WARP: Black 2-ply rayon

FILLER: Greek Handspun - light and dark grey
Goathair - black
Tanki Imports Ltd.

MISCELLANEOUS INFORMATION:

Tie-up and treadling are the same as in Tube A.

Fig. 3-E. Threading draft, four layers, Tubes B and C.



Curved selvedges indicate folds in the weighted warp. Vertical lines in these areas indicate slits or tabs.

Scale: 1 block = 3"

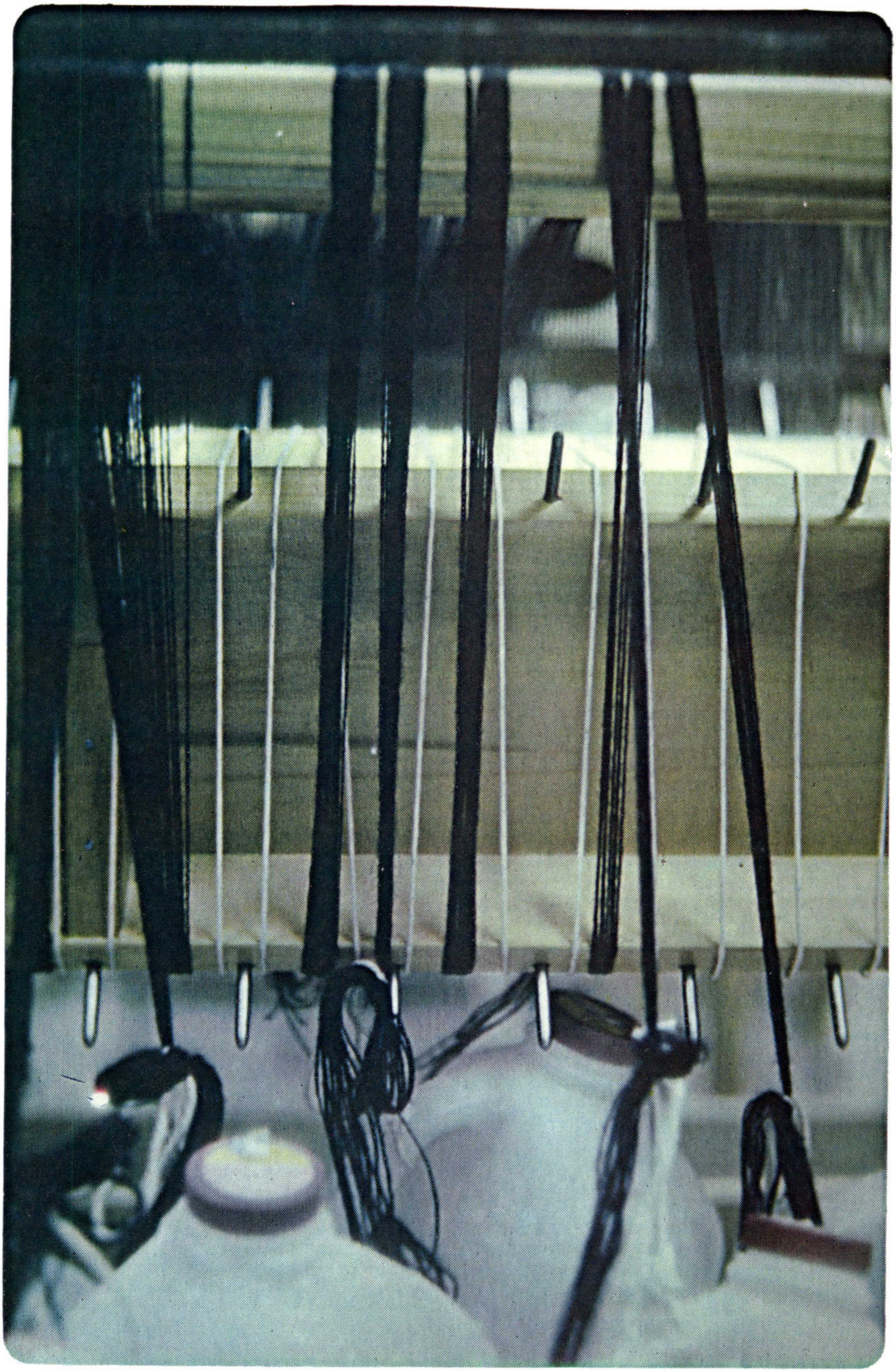


Fig. 3-G. In process work, loom weights

Fig. 3-H. In process work, side view of layers

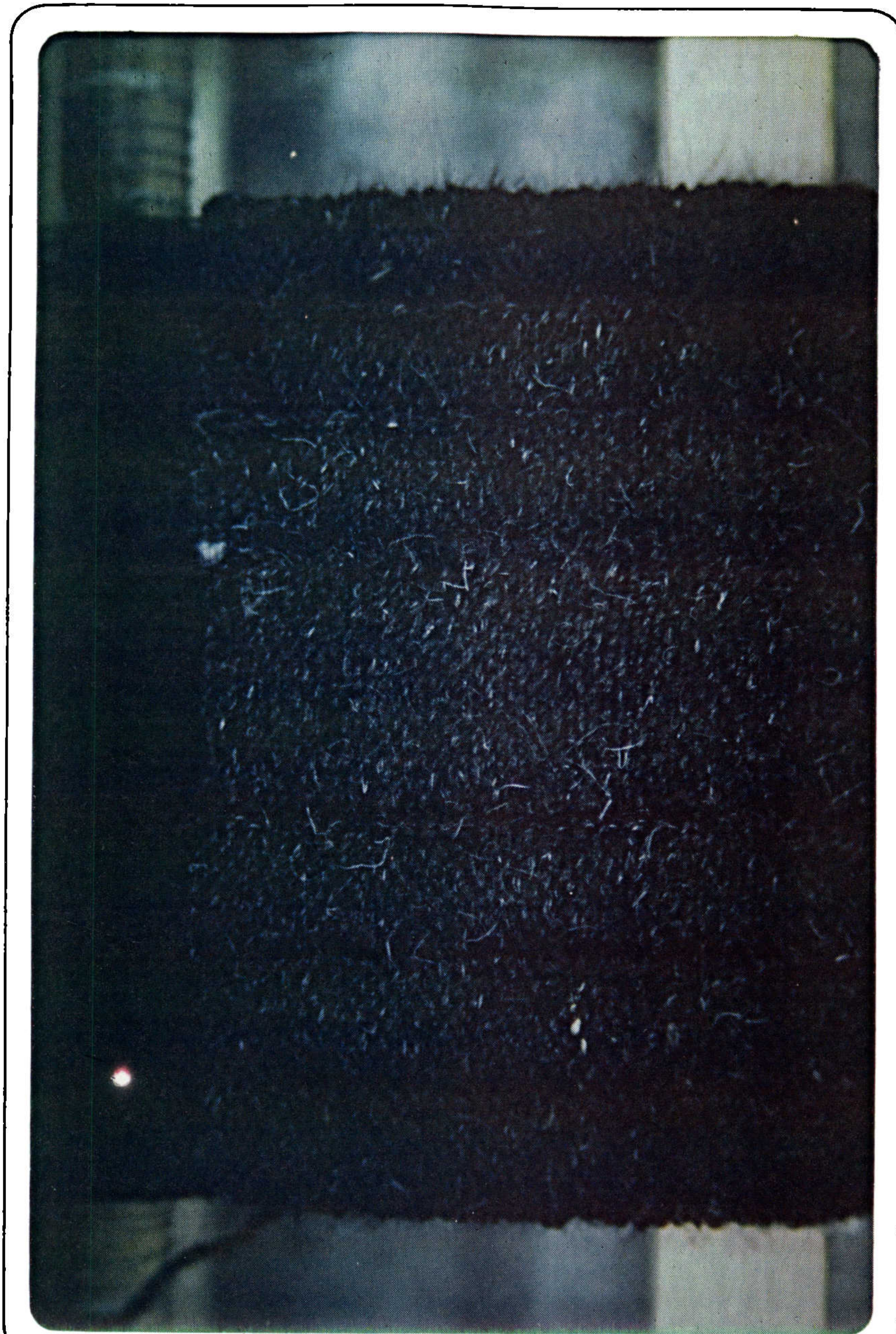


Fig. 3-I. In process work, top view

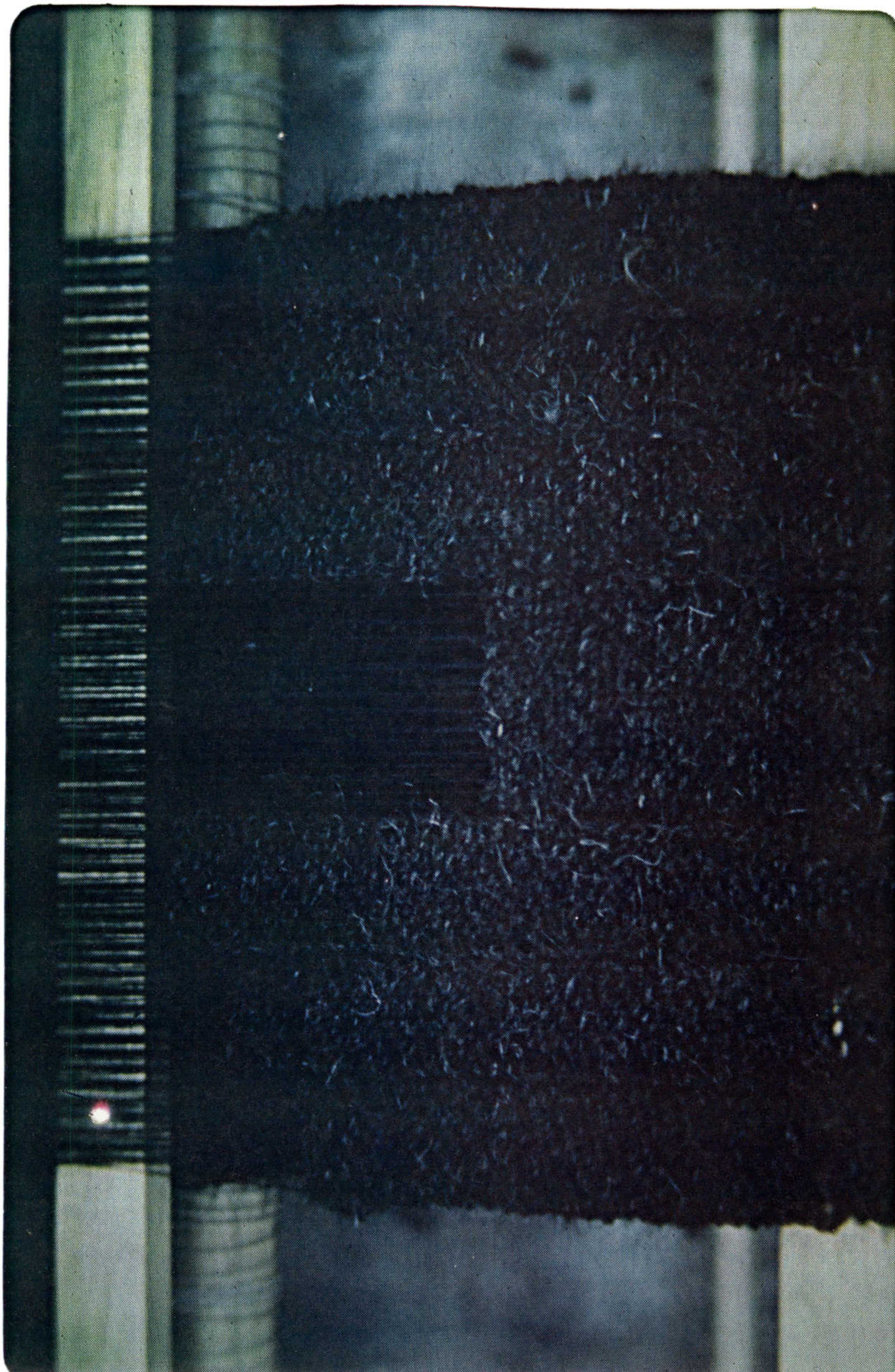


Fig. 3-J. In process work, top view with extensions

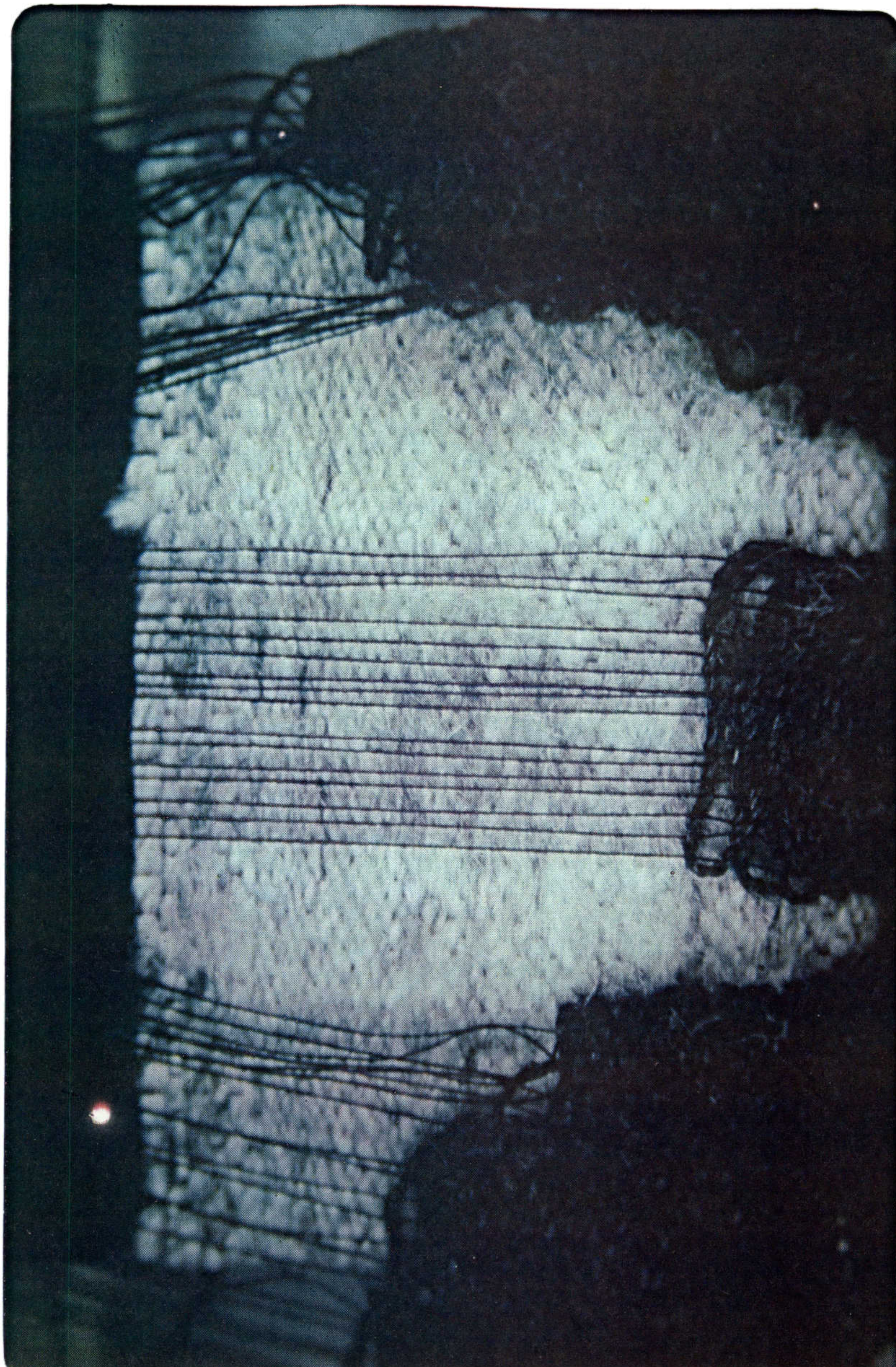


Fig. 3-K. In process work, top view with exposed interior

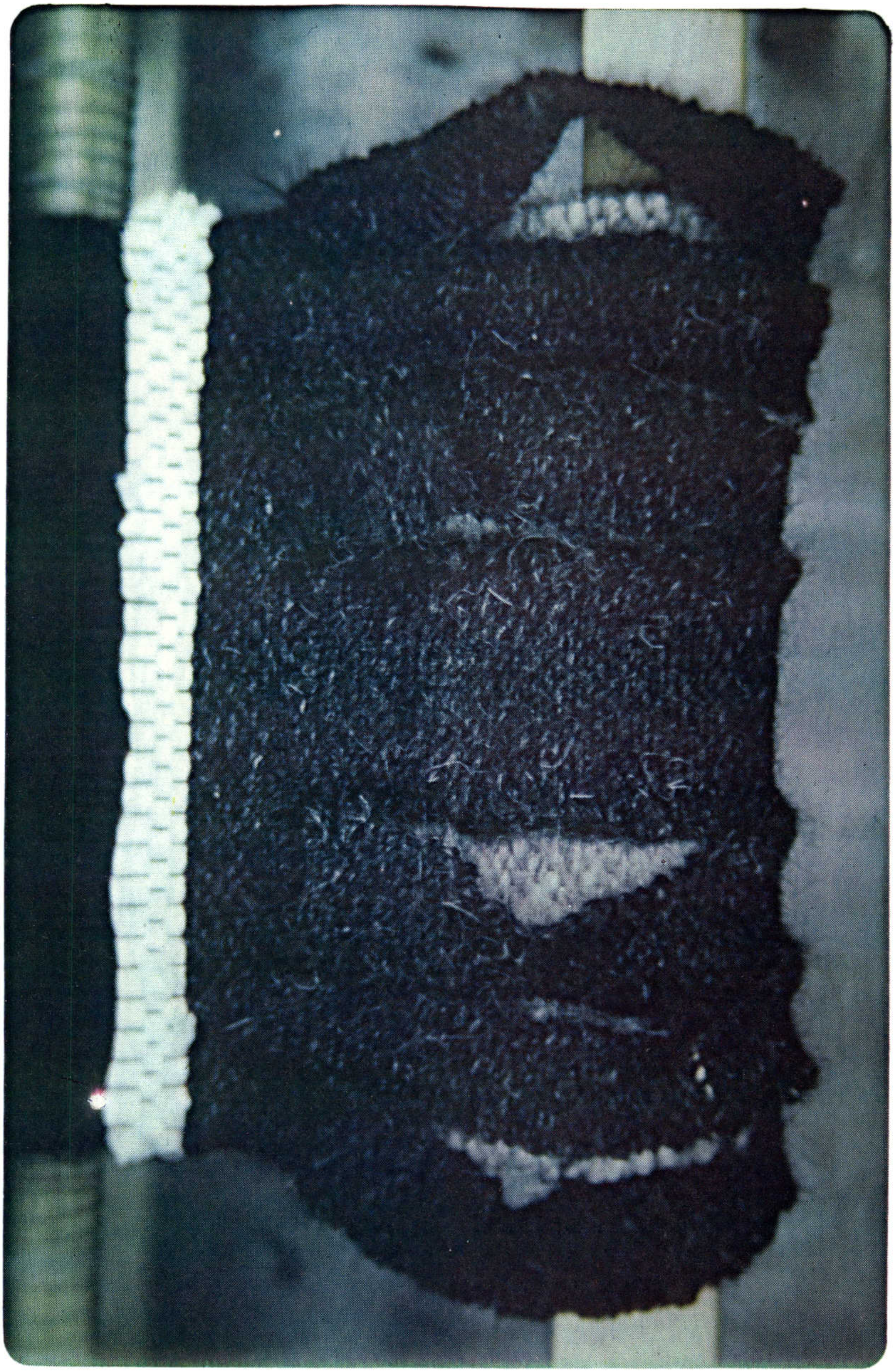
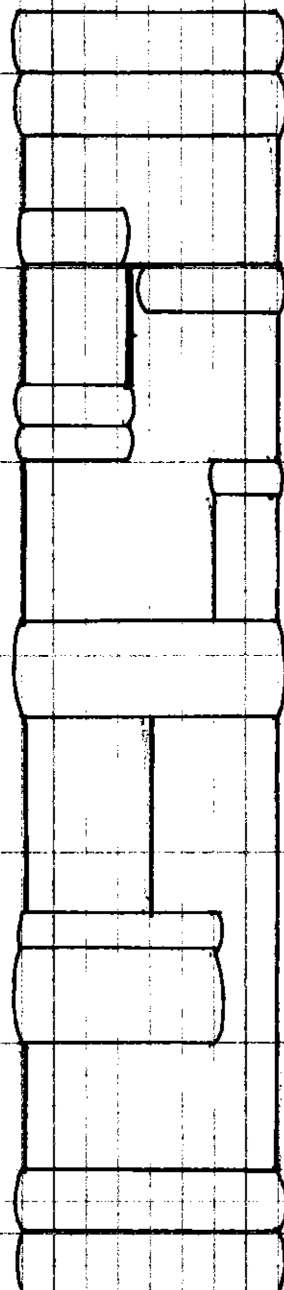


Fig. 3-L. In process work, top view with weighted areas woven into place.

Fig. 3-M. Tube B, front view

Fig. 3-N. Tube B, side view



The main shaft of this tube is broken down into smaller tubes. Curved selvedges indicate folds in the weighted warp.

Scale: 1 block = 3"

Fig. 3-O. Diagram of Tube C

Fig. 3-P. Tube C

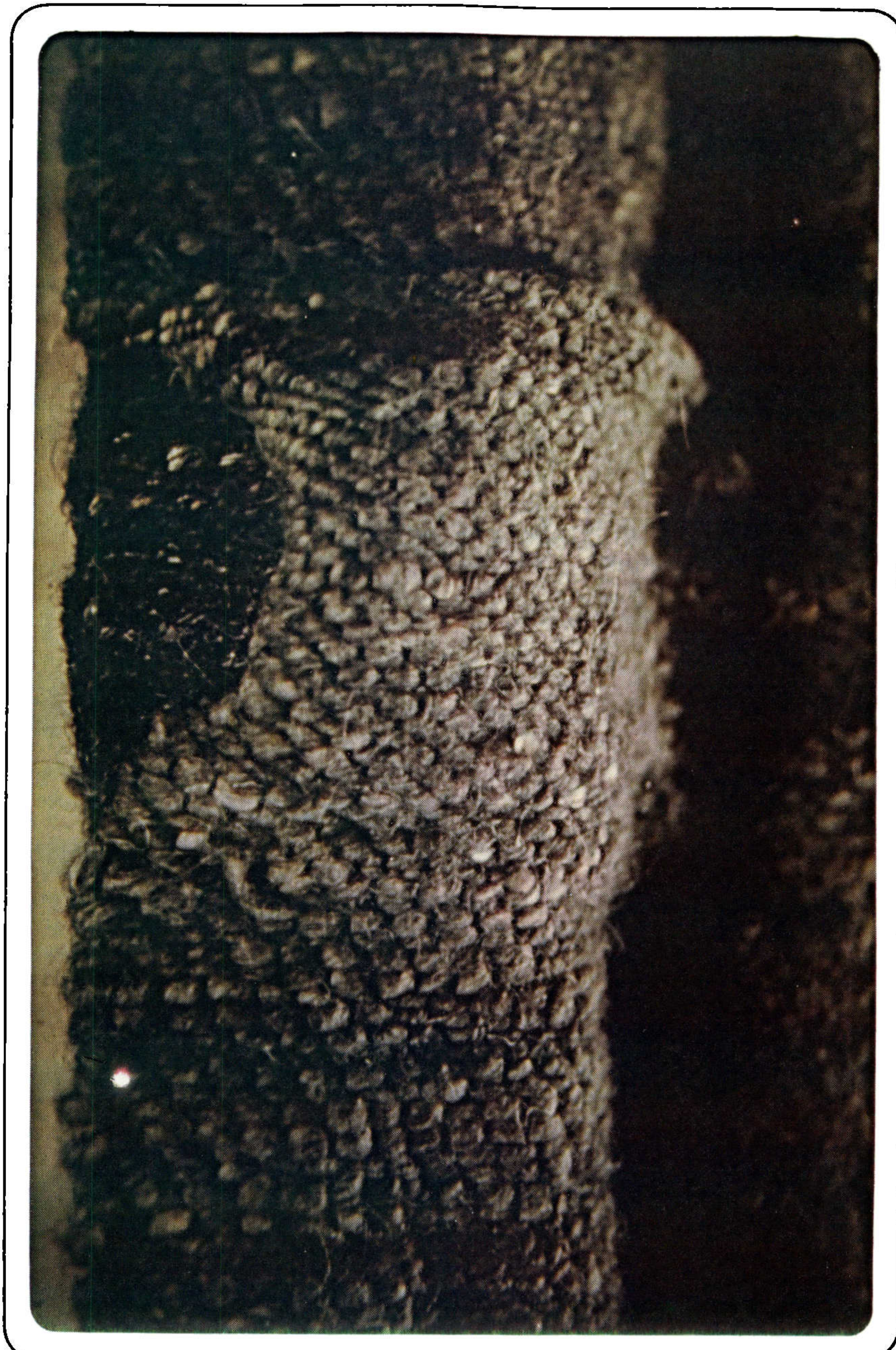


Fig. 3-Q. Detail of Tube C

CHAPTER III

CONCLUSION AND SUMMARY

I feel that my investigation of warp distortion and manipulation has been successful in that I have answered the three questions set up in my statement of the problem.

In answer to the first problem, it was found that weight variations on a single layer fabric yielded sculptural effects in the form of folds. Narrow weighted areas, two to three inches wide, produced a more uniform series of small folds. Wider weighted areas tended to drape rather than fold. It was also determined that the difference in tautness between areas of loom-controlled tension and weighted tension had a pronounced effect on the warp distortion--the greater the weight difference, the more distortion. The number of warp ends per inch was also a determining factor in the folding action of the fabric with fewer warp ends per inch allowing significant folds and more warp ends per inch allowing less obvious folds.

Significant sculptural effects were also achieved with the two fabric layer construction described in the second problem in which loom-controlled tension on one layer was combined with weight-controlled tension on the other. Effects achieved are the result of the weaver's manipulation of the weight-tensioned layer. Manipulations took the form of open-ended folds whose arrangement, size and interaction yielded a variety of effects. However, the basic warp manipulations, or modules, remained the same.

Four layer fabric construction was utilized in the third problem. Two of the layers had loom-controlled tension, while the tension on the other two was weight controlled. Once again, the sculptural effects were the result of the weaver's manipulation of the weighted layers. The effects achieved were much more diversified than in previous problems.

Surface manipulations on the first four-layer tube took the form of folds which spanned the circumference of the piece. These folds could be controlled and arranged at the weaver's discretion.

On the second four-layer tube, the surface variations took the form of folds with slits woven within the body of the piece and also on the selvedges. These slits were utilized to reveal the interior space of the woven construction.

The same type of surface variation was utilized on the third four-layer tube. Rather than combine it with the simple tube-within-a-tube construction previously utilized, the main shaft of the tube was split into multiple tubes. It was possible to produce previous variations on each of these multiples.

In order for this technique to be used successfully, it was determined that all fabric layers must be woven. This would avoid any slippage or shifting in the folds. It was further determined that the characteristics of the weft yarns would affect the type of fold achieved. Stiff yarns would not pack together to achieve a rigid fold, whereas soft yarns would pack to form rigid folds.

Weaving multiple layers to achieve sculptural effects had some interesting results. There were some distinct disadvantages to weaving complex systems of warp-weighted tubes on a floor loom. One of these was that the bottom layer could not be viewed during the weaving without getting under the loom. Therefore, all surface variations had to be uniform for top and bottom layers or occur only on the top layer. It should be noted that due to the nature of the weaving process on a floor loom, tubular forms are woven flat and there is sometimes difficulty in forcing them into a cylindrical shape.

It is the opinion of this weaver that in order to utilize fully the possibilities of warp-weighting in tubular weaving, all sides of the piece must be viewed during the weaving process. One solution would be to weave on an upright frame loom where the lack of a shedding device would be overshadowed by the fact that the weaver would be able to view the piece as a whole and from all sides during the weaving process. Since any upright frame loom does not require that the woven fabric be wound onto a cloth beam, the tube would not have to be flattened during weaving but would be allowed to maintain an open tubular form from beginning to end.

My investigations in warp-weighting were primarily used with tubular forms, but I do not feel that the effects achieved were reliant upon a tubular form to be considered sculptural. Some of the surface variations were more pronounced than others, but all of the techniques produced significant results.

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